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## Re-Emergence of Measles: A Preventable Disease

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Re-Emergence of Measles: A Preventable Disease

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Independent Study

Jana Zwilling

4-09-2015

PERMISSION

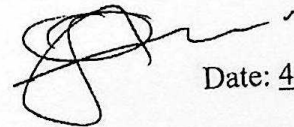
Title: Re-Emergence of Measles: A Preventable Disease

Department: Nursing

Degree: Master of Science

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## Abstract

Since the year 2000, when the United States of America declared measles eradicated from all its regions, this country is currently experiencing its highest rate of measles infection. In 2014 alone, across, America there were 16 reported measles outbreaks with close to 500 reported infection cases. This situation raised concerns in both the public health care system and health care policy making. This literature review focuses on, (1) a timeline (1989-2015) of reported measles outbreak across the United States. (2) The relationship between measles immunization or lack of immunization in the number of infected persons; and a person's risk of getting infected in the general public. (3) Signs and symptoms of measles infection health care providers need to watch for during current outbreak. To explore these research questions, on-line research using key words search was conducted. A sample case study of a 9 year old female diagnosed with measles in Grand Forks, North Dakota will also be discussed in this paper. Successful eradication of measles was demonstrated in the past when immunization against the virus was optimum, clinicians are in a position to improve vaccination rate by encouraging and educating their patients to get vaccinated

**Key words:** eradication, elimination, immunization, measles, measles infection, measles virus, measles vaccine, vaccination.

## Background

Measles is a highly contagious infection caused by the measles virus. The virus is airborne and transmitted through respiratory droplets. Before the introduction of measles vaccine, millions of people died of the infection annually worldwide (Moss & Griffin, 2011). In the United States, most people born before 1963, when a national vaccination program against measles was implemented, were infected with measles before they became adults (Center for Disease Control and Prevention [CDC], 2011a; Walter, Orenstein, Papania & Wharton, (2004). The CDC (2011a) estimated 3-4 million persons were infected with measles yearly. The Center for Disease Control and Prevention (2011b), also reported that before the advent of measles vaccine, approximately 500,000 persons contracted measles, from which 500 persons died, other 48,000 persons were hospitalized, while 1,000 infected others ended up brain died from encephalitis resulting from measles infection (CDC, 2011a; CDC 2011b). The measles vaccination program started in 1963 in the United States as a 2-dose vaccine with the first dose given at 12-15 months of age and a second dose at ages 4-6 years (CDC, 2011b). The United States measles vaccination program successfully controlled measles so well that in 2000, the United States declared measles eradicated from the country following successful interruption of endemic transmission of the disease (CDC, 2011a; CDC, 2011b). However, there continue to be reports of widespread measles infection in many countries outside the Western Hemisphere. Each year, an estimated 20 million new cases of Measles occur worldwide with approximately 164,000 deaths related to the disease in 2008 (Center for Disease Control and Prevention, 2008; CDC, 2011b). Due to the presence of measles elsewhere in the world, United States sometimes see, measles outbreaks from international importations in mostly unvaccinated people who transmit the disease to communities within the U.S. (CDC, 2011a).

Unfortunately, recent outbreaks and reemergence of measles seen in the US pose a threat to past remarkable achievement made to eradicate measles. Measles has demonstrated how quickly it can reemerge in communities with the current outbreaks in US (Moss & Griffin, 2011). Current data reveals international travels and a suboptimal level of measles vaccination across the US are primarily responsible for the threat to continued measles infection control seen in the past when immunization rates in US communities was higher.

Included in this paper is the case of a 9 year old girl who present to clinic with her mother for evaluation of cough, fever, runny nose, red eyes, fatigue and rash. On history taking, it was noted the patient and her family recently moved to Grand Forks, North Dakota from California where there was outbreak of measles. Patient and her older sister are home schooled. Both children have not received any age appropriate immunizations because mom does not believe in immunization. Patient examination revealed infection with the measles virus. Patient and mother were educated on measles infection, need for isolation to prevent spread and patient care. The importance of immunization as preventive health care measure was also discussed with patient's mother during this visit.

The purpose of discussing this case in this paper is to alert clinician's all over America to the possibility of encountering measles in practice regardless of practice location or remoteness to recent outbreak areas.

## Case Report

Age: 9 years  
DOB: 2-24-2005  
Gender: Female  
Allergies: None

CC: Cough, fever, runny nose, red eyes, fatigue, and rash

Naomi is a 9 year old female brought to clinic by mom with chief complaints of fever, dry cough, runny nose with clear secretions, red eyes, sore throat with pain rated 6/10, fatigue and rash that started 1 week ago. The patient said she started to feel mild constant achy pain rated 7/10 in both eyes three days ago, although there was no discharge noted. Naomi also reports a new onset of sweating in the mornings and decreased activity due to fatigue. She denied headache, earache, nausea and vomiting. Patient reports drinking lots of water, eating and sleeping well. Naomi reports being the only one sick at home and that her family moved to this area 1 week ago from California.

Naomi is not on any medication currently; she has no significant past medical history, surgeries or recent hospitalization; she has met all developmental milestones and has enjoyed good health per her report. Naomi lives with her non-smoker mom and a 12-year-old sister on a farm. Naomi and her older sister are home schooled and has never received immunizations because her mother does not believe in them.

### Review of Systems:

GENERAL: Positive for fatigue, fever, decreased activity

HEENT: Negative headache, earache, eyes discharge, positive for red achy eyes, runny nose, sore throat

RESPIRATORY: Positive for dry cough

SKIN: Positive for rash

CARDIOVASCULAR: Negative for cyanosis, SOB

GASTROINTESTINAL: Negative for nausea, vomiting, constipation, diarrhea, anorexia

UROLOGICAL: Negative for anuria

### Physical Exams:

Vitals: Temp 102, R 18, P 100, 110/50, Wt 72 #

Patient was in no acute distress; she appeared stated age, was dressed for the season of the year and responded appropriately to questions. Head midline, normocephalic, no shortness of breath noted. Her physical examination revealed regular heart rate and rhythm. Patient was positive for mild fever, elevated pulse, confluent maculopapular facial/abdominal rash, intermittent non-productive cough, pink conjunctivae that were tender to touch without discharge, red spotted throat, with moderate difficulty swallowing, + 2 sized tonsils bilaterally and post nasal drip. She

was negative for lymphadenopathy, nasal congestion, abdominal pain and bowel sounds were active on all-quadrant.

Differential Diagnosis:

1. Strep throat
2. Measles
3. Varicella

The most likely cause for Naomi's symptoms is measles as her strep test was negative for strep infection. The presence of fever, maculopapular facial rash, koplik spots on the buccal mucosa, cough, eye irritation and report of the runny nose are suggestive of measles infection. In addition, Naomi also has a recent history of residency in the State of California where CDC report measles outbreak in local communities. An oral fluid assay to detect both IgM and IgG measles antibodies to confirm the diagnosis of measles infection are in progress.

Plan:

As we await diagnostic lab results for measles infection, the treatment plan for the patient includes education to patient and mom for Naomi to be isolated at home as much as possible for the next two weeks. She should be encouraged to drink lots of fluid and rest, mom should monitor the patient for worsening condition or non-improvement in condition to return to the clinic or take the patient to an emergency room. Naomi's Mom was educated on what to watch for in other family members and to come to the clinic if she notices any signs or symptoms similar to Naomi's. Mom was further encouraged to consider immunization for both her children in the future and to have herself and older daughter get the measles vaccine if they were not already infected.

Medication order

- Children's Tylenol showable 80 mg/tab, give two tabs every 6 hours as needed for fever, no more than 8 tablets per day.
- OTC Robitussin, give 5 ml every 4 hours as needed for cough.

Measles infection will be reported to North Dakota Department of Health which will report this case to CDC because measles are reportable in the United States.



## Re-Emergence of Measles: A Preventable Disease

## A Review of Literature

According to Center for Disease Control and Prevention (2012), measles infections are characterized by malaise, rash, loss of appetite, fever and “the three C’s” coryza (runny nose), cough and conjunctivitis (red, watery eyes). Just before the appearance of the rash, small white spots with bluish-gray centers (Koplik spots) may be seen on the oral mucosa (National Institute for Communicable Disease [NICD], 2015). Infection from this disease originates from the measles virus spread mainly from respiratory droplets within a short distance when an infected person sneezes and less commonly by measles virus suspended in the air as small particles for a long time (Moss & Griffin, 2011). Measles virus has an incubation period of about ten days before onset of fever. The associated rash has an onset of 14 days although, the period may be longer in adults (NICD, 2015). Moss and Griffin (2011) state that from the time of infection to the first evidence of signs and symptoms of measles infection is 12.5 days. The researchers further explained that several days before and after the rash appears in infected persons, the person is infectious. This is due to concentrations of measles virus being highest in both body fluid and blood at this time, the same time when symptoms of sneezing, cough and coryza are most severe (Moss & Griffin, 2011). Measles infection can be uncomplicated, where clinical recovery begins in infected persons as soon as the rash appears. Complications of measles occur in 40% of infections and such complications sometimes lead to death (Moss & Griffin, 2011). Since 1963, the US initiated national measles immunizations to prevent infection across the country and its other regions. In the year 2000, the United States declared measles eradicated because national measles vaccination was able to break the cycle of measles transmission. United States pre-vaccine era saw close to 500,000 reported measles cases yearly, of this number, about

500 persons died from the infection (McLean, Fiebelkorn, Tente & Wallace, 2013). After the 1963 initiation of the one-dose measles vaccination, numbers of reported measles cases decreased to about 22,000-75,000 each year in the late 1960s and early 1970s (McLean et al., 2013). From 1984 to 1988, the number of reported cases dropped further to an average of 3,750 measles infections annually. However, it was during this period that measles outbreak in school-aged children occurred, an occurrence that prompted a new recommendation to change the measles vaccine dose. This changed to a two – dose measles vaccine combined in mumps and rubella are for all school age children (McLean et al., 2013). The practice 2 dose vaccine continues to this day across the US.

During the years 1989 through 1991, the United States saw its first major measles resurgence, an outbreak that reported approximately 55,000 measles infection and 120 deaths related to the infection (McLean et al., 2013). The reemergence of measles seen during this period were linked with a decrease in measles vaccination noted mostly amongst pre-school aged children living in urban areas (McLean et al., 2013). In 1993 the US, in an effort to increase vaccination coverage, funded a children's vaccination program that was cost free to eligible children below nine years of age (McLean et al., 2013). Positive impact of the measles vaccination program and the 2 dose vaccine became apparent in 1995 when only 309 cases of measles were reported. The decrease in infection rate backed by both laboratory and epidemiologic data prompted the US to declare successful interruption of indigenous measles transmission (Maclean et al., 2013). In 2000, measles was verified and documented as eliminated from America and its regions meaning that there had been no reports of continuous measles transmission over 12 months (McLean et al., 2013). Over the years, measles vaccination has proved to be the best prevention of the disease. However, there continue to be some people who

will not get vaccinated for personal and /or religious reasons. Measles infections are reportable in the United States. Each case is reported to local state health department who, in turn reports to the CDC, and all confirmed measles cases are reported to the National Notifiable Disease Surveillance System (American Council on Science and Health [ACSH], 2014)

Even though the United States, in 2000, declared measles eliminated in all its regions, the CDC published reports from across the nation of measles infection from 2001 – 2008, median annual report ranged between 37-140 yearly in their May 2011 article. Based on the CDC 2011 report, the first 19 weeks of 2011 recorded 118 reported measles cases in 24 states, of the 118 cases, 105 were associated with international importation. A majority of the imported cases were by foreigners visiting the US while other importations were by mostly un-vaccinated US residents who traveled abroad and returned infected with the measles virus (CDC, 2011b).

Below is a table showing details of infected persons in 2011 by age and immunization status.

Measles infection in 2011 (January 1<sup>st</sup> —May 20<sup>th</sup>) across America

Ages	Numbers	Imported Cases	Vaccinated	Unvaccinated
Three months -68 yrs.	118	105	13	-

Source CDC 2011

Table 1

As people continue to travel back and forth from the US to countries where measles remain prevalent, importation of the virus to American communities will emerge from time to time. Measles outbreaks will remain difficult to prevent in the face of declining number of vaccinated people in communities as demonstrated by the updated 2013 CDC report of 159 cases of measles from 17 US states (CDC, 2013). The Center for Disease Control and Prevention

(2013) noted that almost two-thirds of reported measles cases were from three outbreaks in communities with unvaccinated persons.

Measles outbreak in 2013 (January 1<sup>st</sup> —August 24<sup>th</sup>) across America

Ages	Numbers	Vaccinated	Unvaccinated / Unknown Status	Imported Cases	Unknown Source
0 days - 61 yrs.	159	13	146	157	2

Source CDC 2013

Table 2

In 2014, there were 21,420 confirmed measles cases including 110 deaths in the Philippines. During the same time in the US, 25 people who traveled to the Philippines from the United States fell sick from measles virus. Most of the infected travelers were unvaccinated against measles and they spread the virus to their local communities (Center for Disease Prevention and Control, 2015). Following the measles outbreak in the Philippines, the World Health Organization and the Philippines Department of Health organized a nationwide measles vaccination campaign to control the outbreak (CDC, 2015). Concurrently, in the US, CDC recommended 1 dose measles vaccine (infants 6-11 months), 2 dose measles vaccine (children 12 months and older) for people traveling to the Philippines to protect them against the virus. An additional measure put in place by the CDC was to advise all clinicians to consider measles infection when treating patients presenting with rash and fever, especially if such patients had association with or a history of recent international travels (CDC, 2015a). Following the 2014 measles outbreak in the Philippines and despite the CDC's recommendation to international travelers to get vaccinated against measles, California Department of Public Health (CDPH) got

its first notification of a suspected measles case on the 5<sup>th</sup> of January 2015 (Zipprich, Winter, Hacker, Xia, Watt, & Harriman, 2015). This first patient was a hospitalized 11-year-old unvaccinated child whose rash started December 28, 2014. The affected child's only notable travel history at the time of infection was to Disney's theme park in Orange County, California (Zipprich et al., 2015). On the same 5<sup>th</sup> of January, 2015, CDPH also received additional reports of four other suspected measles case also in California and two cases in the state of Utah. All infected persons had a recent history of visits to the same Disney theme parks located in Orange County California from 17<sup>th</sup> – 20<sup>th</sup> of December, 2014 (Zipprich et al, 2015). By the 7<sup>th</sup> of January, 2015, there were seven confirmed measles cases in California which prompted the state to release a notification to other states in the country of an outbreak and to alert the country that there was ongoing measles transmission (Zipprich et al., 2015).

As of February 11<sup>th</sup>, 2015, the US had confirmed 125 measles infection cases with onset of rash between 28<sup>th</sup> December, 2014 to 8<sup>th</sup> February 2015 related to current outbreak; 110 of the confirmed cases were residents of California, 39 of the 110 patients visited Disney theme park during exposure periods between 17<sup>th</sup> -20<sup>th</sup> of December 2014 (Zipprich et al., 2015). Other US states accounts for 15 other measles cases seen with this outbreak: Arizona 7, Nebraska 1, Colorado 1, Utah 3, Oregon 1, Washington 2 in addition to cases connected to our neighbors, Canada 10 and Mexico 1 (Zipprich et al, 2015). The CDC (2015b) explained the initial source of measles exposure at the Disney theme park is yet to be identified. Although, measles genotype B3 specimen was collected from 30 of the infected patients in California which matched the genotype of the virus that the caused the large measles outbreak in the Philippines last year. The same measles B3 strain was also noted in no less than six US states and 14 other countries during

the same time frame of the US outbreak (Zipprich et al., 2015). The breakdowns of infected persons in the 2014-2015 measles outbreak in California alone are in the table below

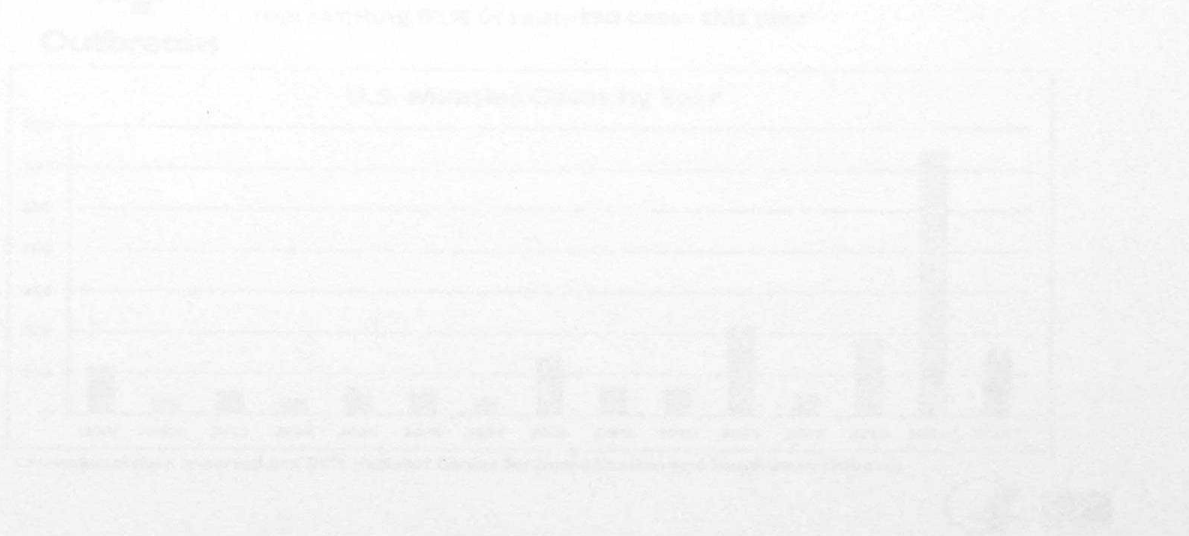
Measles outbreak in California (December 2014 — February 2015)

AGES	Numbers	Unvaccinated / Unknown Status	Vaccinated /Immunoglobulin G seropositivity	Unknown source
6 wks. - 70 yrs.	110	49	14	47

Source Zipprich, 2015

Table 3

The latest CDC report of measles infection in the US as of April 3<sup>rd</sup> 2015 states that since from January a total of 159 cases from 18 states in addition to the District of Columbia have been confirmed (CDC, 2015c). Below is a CDC map showing states affected by current measles outbreak and a graph from CDC website displaying measles re-emergence from 2001 to 2015 across the United States.





In light of the recent re-emergence of measles seen in developed countries like the United States and Canada, it becomes evident how fragile and reversible any nation's claim to measles eradication truly is. Since 2000 when the US announced it had successfully interrupted measles transmissions across its regions, there have consistently been outbreaks, some small and other not so small across the Americas. The reason for intermittent measles outbreaks across America is attributable to the vaccination status, or lack thereof, noted amongst pockets of US residents. From the inception of the measles vaccine in 1963, there was a clear record of its effectiveness in preventing measles transmission and protecting the public from outbreaks. Unfortunately, as time went on, there has been a marked decline in measles vaccination rates all over America. Vaccination, especially community immunization protects the health of most. When a community is immunized in the majority of communicable diseases, like measles, they are protected. However, pockets of unimmunized people in a community will compromise public health in their locale.

Measles is one disease clinicians across America always have to consider when patients present with rash, fever, and red eyes because the possibility of encountering this condition will always be present. So long as humans continue to travel from country to country and region to region, there will be other countries out there that are still dealing with measles epidemic. Therefore, international travel plus declined measles vaccination means exposure to the virus and risk of infection to the general public. As observed in the case study, no state, city, town, rural or urban area is safe from the measles virus. California would appear to be very far from Grand Forks, North Dakota yet, the patient had classic signs of measles. The only way a clinician could have connected the patient to the measles outbreak in California would have been to have a thorough history of recent travels. Lessons learned from the case is clinicians need to keep



abreast with public health news and should watch out for symptoms of any CDC reported disease outbreaks in their locale.

### Learning Objectives

- Measles infection can appear any time and any place in the United States
- Health care workers should collect travel and detailed history from any patient with generalized rash, cough, eye irritation, fever, koplik spots on oral mucosa, and runny nose
- Isolate, anyone, known to have measles
- Report confirmed cases of measles to state public health department
- Educate and teach all patients and families about the importance of measles immunization

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